CONTENT AND TRUE DIGESTIBILITY OF THE AMINOACIDS OF HULL-LESS BARLEY IN EXPERIMENTS WITH MUSCOVY DUCKS

СЪДЪРЖАНИЕ И ИСТИНСКА СМИЛАЕМОСТ НА АМИНОКИСЕЛИНИТЕ НА ГОЛОЗЪРНЕСТ ЕЧЕМИК ПРИ ОПИТИ С МУСКУСНИ ПАТИЦИ

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ABSTRACT

Using adapted methods for balanced experiments with waterfowl, the content and the true digestibility of the amonoacids of hull-less barley have been established. The following contents of the essential amonoacids of a stocking lot of the forage have been established (g/kg DM): lysine-4.8, methionine-1.1, cystine-1.1, histidine-2.2, threonine-4.4, leucine-6.8 and phenylalanine- 5.9. The coefficients of their true digestibility were 81.89, 84.06, 85.08, 90.62, 87.30, 76.38 and 75.96, respectively.

KEYWORDS: Amonoacids, true digestibility, hull-less barley, Muscovy ducks

РЕЗЮМЕ

Ползвайки адаптирана за гъски методика за балансови опити, са установени съдържанията и истинската смилаемост на голоозърнест ечемик. Установени са следните съдържания на незаменими аминокиселини в стокова партида от фуража (g/kg СВ): лизин-4.8, метионин-1.1, цистин-1.1, хистидин-2.2, треонин-4.4, лейцин-6.8 и фенилаланин- 5.9. Коефициентите на тяхната истинска смилаемост са съответно: 81.89, 84.06, 85.08, 90.62, 87.30, 76.38 и 75.96.

КЛЮЧОВИ ДУМИ: Аминокиселини, истинска смилаемост, Голозърнест ечемик, Мускусни патици

РАЗШИРЕНО РЕЗЮМЕ

Напоследък, високопродуктивните породи и хибриди птици показват значителни варирания в трансформацията на фуражния протеин в продуктивен. Основнотно обяснение за ниската трансформация е не само в незадоволителното аминокиселинно съотношение, но и във включването на фуражи с ниска достъпност на аминокиселините. Най – застъпеният метод за нейното определяне при птици е установяването на истинската смилаемост на аминокиселините.

Целта на настоящото изследване е да се установят аминокиселинните съдържания на 4 перспективни линии на голозърнест ечемик, както и тяхната истинска смилаемост при опити с Мускусни патици.

През 2003 год. бяха проведени балансови опити с 12 едногодишни Мускусни патока. Бе използвана модифицирана за водоплаващи птици методика на Sibbald (1986). Иситнската смилаемост на аминокиселините на осреднена стокова партида от фуража бе изчислена по формулата:

(АК във фуража - (екскретирана АК от захранени аналози – екскретирана АК от гладуващи аналози))/ АК във фуража

Средната истинска смилаемост на аминокиселините бе определена по формулата:

∑(АК х коефициента на смилаемост)/ ∑АК

Бяха установени съществени разлики в аминокиселинното съдържание между отделните линии, особено при преизчисление на база сухо вещество. Може да се заключи, че българските линии на фуража не са консолидирани по аминокиселинен състав.

Средната истинска смилаемост на аминокиселините на осреднена стокова партида от фуража е 81.29, а на незаменимите аминокиселини- 81.31. Двете стойности кореспондират сравнително точно със смилаемостта на суровия протеин (78.89). От незаменимите аминокиселини, по – високи от средната смилаемост са показали хистидинът (90.62) и треонинът (89.30), а по – ниски от средните - тирозин (74.10), фенилаланин (75.96) и лейцин (76.38). Лизинът, метионинът и цистинът имат коефициенти на смилаемост съответно 81.89, 84.06 и 85.08.

INTRODUCTION

Besides the energy nutrition value of the forages, the protein nutrition value is the most important factor in nutrition of agricultural animals and fowls. The crude protein content suggests roughly the protein nutrition value, because the animal organism should first disintegrate the proteins to amonoacids, which are afterwards absorbed and included in the building processes [9].

In the latest highly productive fowl breeds and hybrids the transformation of the protein from the food rates into productive one varied within broad ranges – in broilers it was from 35 % [4] to 55.2 % [5]. Similar variations were also observed in other fowl species. A definite opinion has been reached that the low utilization of the crude protein was not only due to its insufficient amonoacid balance [5] but also to the insertion of forages with low availability of aminoacids [1]. Aminoacid availability is a term meaning the degree of their utilization in the organism for protein synthesis and other metabolic processes, expressed in percentage [3]. Fuller & Wang (1989) underlined that aminoacid availability was determined as a ratio between the aminoacids absorbed and used for protein synthesis, but detecting that ratio was difficult to be realized in practice and, thus, the authors suggested to use aminoacid digestibility as an index of their utilization. Out of the 8 methods used (divided in two groups in vitro and in vivo), the most widely applied in fowls in the last years was the method of determining the true digestibility of the aminoacids, described by Sibbald (1986). The method is comparatively simplified and easy to use, providing high precision in detecting the amount of the aminoacids absorbed and released, in balanced experiments with fowls, as well as the amount of the released from the digestive system of the feed deprived analogues (endogenous losses of amonoacids).

The hull-less barley is a comparatively new forage crop for Bulgarian breeding. Its advantages are to be found mainly in the low content of crude fibers that can contribute to the better digestion of the nutrient substances, including aminoacids, by the birds.

The aim of the present study was to detect the amonoacid content of 4 perspective lines of hull-less barley, as well as their true digestibility in experiments with Muscovy ducks.

MATERIAL AND METHODS

In 2003 balanced experiments with 12 one-year old Muscovy drakes were conducted. The methods of Sibbald (1986) were used modified for waterfowl experiments by Penkov (1997). The forage applied was taken from the experimental collection of the Department of Genetics and Breeding, the Agricultural University – Plovdiv.

The aminoacid analysis of the four lines of the forage and the excrements of fed and food deprived analogues was carried out by aminoanalizer AAA881 (preliminary salty-acidic hydrolysis). A stocking lot of the forage by

25 % of each line was used for detecting the digestibility of the aminoacids. Separation of the organic and the non-organic nitrogen was done by the methods of Stoyanov (1957).

The true digestibility of the aminoacids was calculated by the formula of Surdjiyska, 1990:

(AA in forage - (AA excretion of tube fed - AA excretion of food deprived))/AA in forage

The average true digestibility of the aminoacids was detected by the formula:

∑(AA x coefficient of digestibility)/ ∑AA

RESULTS AND DISCUSSION

Table 1 shows the aminoacid content of the four lines of hull-less barley, an object of the experiment.

Significant differences were observed in the aminoacid content, especially when re-calculating them on dry matter basis. It can be concluded that the Bulgarian cultivars are not consolidated concerning their amino acid composition. However, we think that due to the protein uniformity the aminoacid digestibility coefficients would not differ much and detecting the digestibility of a stocking lot of the forage will be of great practical importance to fowl nutrition.

Compared to common barley [6], the hull-less barley displayed some differences in the aminoacid content. The differences in absolute percentage units were the following: for lysine: +0.07, methionine: -0.7, histidine: -0.03, threonine: +0.14, proline: -0.42, valine: -0.07, isoleucine: -0.09, leucine: -0.12 and tyrosine: -0.10. The lower levels of the aminoacids were corresponding to the lower levels of crude protein in the different lines of hull-less barley, the differences in comparison with the common barley varying between –4.98 to –2.22 (-3.70 percentage units per a kg of DM in average).

Table 2 presents the coefficients of true digestibility of a stocking lot of hull-less barley.

The average true digestibility of the aminoacids was 81.29 and of the essential aminoacids – 81.31, both values corresponding comparatively exactly to the crude protein digestibility (78.89). Out of the essential aminoacids, above the average values were manifested by histidine (90.62) and threonine – 89.30, and, below the average values – by tyrosine (74.10), phenylalanine (75.96) and leucine (76.38). The rest of the essential aminoacids had coefficient of digestibility close to the mean values.

Compared to aminoacid digestibility of the common

Table 1: Amino acid contents of 4 varieties of pear barley- yields 2001/2002

Amino acid	Varity Pv103		Varity 557A00299		Varity Pv104		Varity 57A01099		Average	
	In 1 kg fodder	In DM	In 1 kg fodder	In DM	In 1 kg fodder	In DM	In 1 kg fodder	In DM	In 1 kg fodder	In DM
Lysine	0.44	0.50	0.41	0.47	0.46	0.52	0.36	0.41	0.42	0.48
Methion.	0.09	0.10	0.11	0.12	0.12	0.14	0.07	0.08	0.10	0.11
Cystine	0.08	0.09	0.11	0.12	0.14	0.16	0.07	0.08	0.10	0.11
Histidine	0.18	0.20	0.18	0.21	0.20	0.23	0.20	0.23	0.19	0.22
Arginine	0.57	0.65	0.59	0.68	0.63	0.71	0.61	0.70	0.60	0.69
Asparag.	0.58	0.66	0.75	0.86	0.80	0.91	0.53	0.61	0.66	0.76
Threonine	0.30	0.34	0.71	0.81	0.49	0.55	0.25	0.29	0.44	0.50
Serine	0.39	0.44	0.49	0.56	0.58	0.66	0.35	0.40	0.45	0.52
Glutamine	2.35	2.67	2.79	3.19	3.25	3.68	1.80	2.06	2.55	2.90
Proline	1.10	1.25	1.30	1.49	1.56	1.77	0.88	1.01	1.21	1.38
Glycine	0.40	0.46	0.46	0.53	0.53	0.60	0.35	0.40	0.44	0.50
Alanine	0.40	0.46	0.53	0.61	0.58	0.66	0.42	0.48	0.48	0.55
Valine	0.48	0.55	0.53	0.61	0.60	0.68	0.50	0.57	0.53	0.60
Isoleucine	0.28	0.32	0.34	0.39	0.38	0.43	0.27	0.31	0.32	0.36
Leucine	0.67	0.76	0.84	0.96	0.92	1.04	0.69	0.79	0.78	0.89
/Tyrosine	0.23	0.26	0.29	0.33	0.32	0.36	0.20	0.23 0.26		0.30
Phenylal.	0.47	0.53	0.55	0.63	0.64	0.72	0.40	0.46	0.52	0.59
Cr. protein	12.19	13.87	10.44	11.95	11.12	12.60	9.69	11.11	10.86	12.38

Table 2: True digestibility coefficients of the amino acids of pear barley in experiments with geese (n=6)

Amino acid	X	Sx	S%
Lysine	81.89	2.07	14.95
Methionine	84.06	1.63	9.87
Cystine	85.08	2.59	13.51
Histidine	90.62	1.75	11.45
Arginine	81.50	1.25	9.08
Asparagine	89.20	2.12	11.21
Threonine	87.30	1.99	14.48
Serine	73.48	2.91	23.39
Glutamine	80.32	1.00	8.40
Proline	81.58	1.31	12.63
Glycine	86.75	2.67	27.78
Alanine	74.28	2.42	22.34
Valine	85.92	1.91	17.16
Isoleucine	83.56	2.01	10.72
/Leucine	76.38	1.46	11.32
Tyrosine	74.10	2.36	18.88
Phenylalanine	75.96	1.34	10.41
Aver. digest. of the AA	81.29	1.87	-
Aver. dig. of the essential AA	81.31	1.24	-
Dig. of the crude protein	78.89	2.24	10.18

barley [6] some significant differences were reported. Based on digestibility of common barley grains, the differences were, as follows: for lysine: +10.2, methionine: -1.3, cystine: -2, histidine: +8, arginine: -4.9, threonine: +26.5, valine: +6.5, leucine: -9, isoleucine: +6.6 and phenylalanine: -11.5 percentage units.

As a whole the coefficients of hull-less barley aminoacid digestibility showed better results compared to common barley, due to the lower content of crude fibers in the tested forage.

Finally we can conclude that the Bulgarian hull-less barley showed the following average true digestibility of essential aminoacids for fowl (in g/kg of DM): lysine - 3.9; methionine and cystine - by 0.9; histidine - 2.0; arginine – 5.6; threonine - 4.4; valine – 5.2; isoleucine - 3.0; leucine – 6.8; tyrosine – 2.2 and phenylalanine - 4.5.

CONCLUSIONS

The hull-less barley falls behind the common barley by its crude protein content (12.38 % in DM) and by the total content of essential aminoacids in DM by 3.5 % in average.

The average true digestibility of the aminoacids in hull-less barley for Muscovy ducks was 81.29 and of essential aminoacids – 81.31. Histidine (90.62) and threonine (89.30) manifested digestibility above the average values, while tyrosine (74.10), phenylalanine (75.96) and leucine (76.38) – below the average values. Lysine, methionine and cystine had digestibility coefficients of 81.89, 84.06 and 85.08, respectively.

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